



**CD 8.5.1 DISCIPLINE SYLLABUS FOR
UNIVERSITY STUDIES**

Edition: 09

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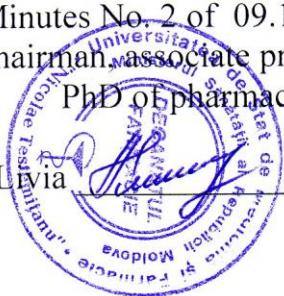
**FACULTY OF PHARMACY
STUDY PROGRAM PHARMACY
CHAIR OF PHARMACOGNOSY AND PHARMACEUTICAL BOTANY**

APPROVED

at the meeting of the Commission for Quality Assurance and Evaluation of the Curriculum in Pharmacy

Minutes No. 2 of 09.11.2021
Chairman, associate professor,
PhD of pharmacy

Uncu Livia



APPROVED

at the Council meeting of the Faculty of Pharmacy

Minutes No 3 of 16.12.2021
Dean of Faculty, associate professor,
PhD of pharmacy

Ciobanu Nicolae



APPROVED

at the meeting of the Chair of pharmacognosy and pharmaceutical botany

Minutes No. 27 of 30.06.2021
Head of chair, professor, Dr. hab. of biol.

Calalb Tatiana

SYLLABUS

DISCIPLINE PHARMACOGNOSY

Integrated studies

Type of course: **Compulsory discipline**

Curriculum was elaborated by author:

Cojocaru-Toma Maria, PhD of pharmacy, associate professor

Chișinău, 2021



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I. INTRODUCTION

- **General presentation of the discipline: place and role of the discipline in the formation of the specific competences of the professional training program**

The discipline of Pharmacognosy is an important component of pharmaceutical education focused on the macro-, microscopical and phytochemical study of vegetable products, which can serve as a source of raw material for vegetable medicinal species and phytodrugs. The theoretical knowledge and the practical skills of pharmacognostical analysis of the vegetal products will contribute to the skills training of the specialist pharmacist: correct and efficient use of natural vegetal resources; advising the patient on the use of phytopreparations; biological and phytochemical studies for the valorization of the local flora.

Knowledge gained during the course of pharmacognosy are necessary for the subsequent assimilation of the disciplines: Pharmacology, Pharmacotherapy, Pharmaceutical chemistry, Toxic plants, thus contributing to the multilateral training of the specialist pharmacist.

- **Mission of the curriculum in professional training**

Pharmacognostic study (macro-, microscopical, phytochemical) of vegetable products containing natural compounds of different chemical classes, according to the Analytical Normative Documentation and familiarization with the sources and rules for the valorification of raw material for different pharmaceutical forms.

The developed skills during the course of pharmacognosy will serve as a landmark in the developing of professional attitudes towards the valorification of vegetal products and medicinal plants with their use in the pharmaceutical industry. Acquired knowledge will contribute to the development of critical thinking in addressing basic issues regarding the rational use of vegetal products and phytodrugs.

- **Language (s) of the course:** Romanian, English;
- **Beneficiaries:** students of the IIIrd year, Faculty of Pharmacy

II. MANAGEMENT OF THE DISCIPLINE

Code of discipline		S.05.O.042 S.06.O.048	
Name of the discipline		Pharmacognosy	
Person(s) in charge of the discipline		PhD, associate professor, Cojocaru-Toma Maria	
Year	IIIrd	Semester/Semesters	V-VI
Total number of hours, including:			270
Lectures	30	Practical/laboratory hours	105
Seminars		Self-training	135
Clinical internship			
Form of assessment	exam (2)	Number of credits	4 (Isem.) + 5 (II sem.)



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III. TRAINING AIMS WITHIN THE DISCIPLINE

At the end of the discipline study the student will be able to:

- **at the level of knowledge and understanding:**
 - medicinal plants - source of vegetal products;
 - biosynthesis scheme for different groups of pharmacologically active chemical compounds;
 - macro- and microscopical characters of the vegetal products, numerical indices that regulate their quality;
 - methods of chemical analysis of vegetal products containing: polyholosides, vitamins, volatile oils, alkaloids, cardiotoxic heterosides, saponosides, anthracene derivatives, phenolic compounds, flavonoids, coumarins, tanning substances;
 - pharmacological action, therapeutic indications, particularities in the administration of vegetal products and phytodrugs
- **at the application level:**
 - identification of vegetal products by macroscopical, microscopical, histochemical characters with the determiner and pharmacopoeias reference;
 - determination of impurities specific for the vegetal products;
 - collecting, drying, primary processing of the vegetal products;
 - packaging, marking, storage of the vegetal products;
 - pharmacognostical analysis of the vegetal products in accordance with the requirements of the analytical normative documentation and the pharmacopoeias reference;
 - the pharmaco-therapeutic action of the active principles of vegetal origin and medicinal products obtained from them;
 - informing of patients, doctors, pharmacists about the rational use of vegetal products and phytodrugs.
- **at the integration level:**
 - determination of the position and importance of Pharmacognosy in the disciplines set provided by the study plan;
 - applying and integrating of knowledge for the subsequent acquisition of Phytotherapy and Toxic plants courses.

IV. PROVISIONAL TERMS AND CONDITIONS

For the assimilation of discipline of Pharmacognosy are necessary knowledge in the field of Pharmaceutical botany, Organic and Analytical chemistry, Latin, Anatomy, Physiology, as well as communication skills ability, teamwork, skills in modern informational technologies, analytical and synthesis skills, generalization and skills of communication, etc.

V. THE MESAND ESTIMATE ALLOCATION OF HOURS

Lectures, practical hours/ laboratory hours/seminars and self-training

No.	THEME	Number of hours		
		Lectures	Practical hours	Self-training
1.	Introduction and generality. Methods of analysis of vegetal products. Polyholosides. Vegetal products containing polyholosides: <i>Althaeae herba, Althaeae radices, Farfarae folia, Laminariae stipites, Malvae flores, Malvae folia, Plantaginis majoris folia, Tiliae flores cum</i>	2	6	6



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No.	THEME	Number of hours		
		Lectures	Practical hours	Self-training
	<i>bracteis, Verbasci flores.</i>			
2.	Learning of methods of pharmacognostical analysis of vegetal products from different morphological groups.	-	3	0
3.	Vitamins. Classification. Vegetal products containing vitamins: <i>Bidenstis herba, Bursae pastoris herba, Calendulae flores, Hippophaes rhamnoides fructus, Maydis stigmata, Ribes nigri fructus, Rosae fructus, Sorbi fructus, Urticae folia, Viburni cortex, Viburni fructus.</i>	2	6	6
4.	Terpenoids. Classification. Biosynthesis. Volatile oils. Generality. Vegetal products containing acyclic terpenoids: <i>Coriandri fructus, Lavandulae flores, Melissa herba, Rosae flores</i> ; monocyclic terpenoids: <i>Carvi fructus, Eucalypti folia, Menthae piperitae folia seu herba, Salviae folia</i> ; bicyclic monoterpenoids: <i>Hyssopi herba, Juniperi fructus, Tanacetii flores seu herba, Valerianae rhizomata cum radicibus</i> . Sources of camphor: <i>Pini sylvestris cormus.</i>	2	6	12
5.	Vegetal products containing sesquiterpenoids: <i>Arnicae flores, Betulae gemmae, Betulae folia, Calami rhizomata, Chamomillae flores, Inulae rhizomata et radices, Populi nigrae gemmae</i> ; aromatic terpenoids: <i>Anisi vulgaris fructus, Asari folia, Asari rhizomata, Basilici herba, Foeniculi fructus, Origani vulgaris herba, Serpylli herba, Thymi vulgaris herba</i> . Resinous substances. Vegetal products containing resins: <i>Convolvuli herba, Lupuli strobili</i> . Bitter substances Generality. Vegetal products containing bitter substances: <i>Absinthii folia, Absinthii herba, Cardui benedicti herba, Centaurii herba, Gentianae radices, Marrubii herba, Millefolii flores, Millefolii herba, Taraxaci folia, Taraxaci herba, Taraxaci radices.</i>	2	9	12
6.	Heterosides. Generality. Classification. Dynamics of accumulation. Collection and storage. Biological standardization. Vegetal products containing heterosides: <i>Amygdalari semina, Sambuci flores, Sinapis semina</i> . Vegetable products containing cardiac heterosides: <i>Adonidis vernalis herba, Convallariae flores, Convallariae folia, Convallariae herba, Digitalis lanatae folia, Digitalis purpureae folia, Erysimi diffusi herba, Strophanthi semina.</i>	2	6	12
8	Saponosides. Generality. Vegetal products containing saponosides: <i>Araliae mandshuricae radices, Dioscoreae rhizomata cum radicibus, Equiseti arvensis herba, Glycyrrhizae glabra radices, Hippocastani cortex, H. flores, H. folia, H. semina, Ginseng radices, Orthosiphonis folia, Polemonii rhizomata cum radicibus, Primulae veris folia, Primulae veris rhizomata cum radicibus, Saponariae radices.</i>	2	6	12
9.	Analysis of pulverized vegetal products.	-	3	0
10.	Alkaloids. History. Classification. Biosynthesis of tropane alkaloids. Vegetal products containing pyrrolizidine alkaloids: <i>Senecionis platyphylloides herba, Symphyti radices</i> ; derivatives of coniine: <i>Conii fructus</i> ; derivatives of nicotine: <i>Nicotianae folia</i> ; tropane alkaloids: <i>Belladonnae folia, B. herba, B. radices, Daturae innoxiae herba,</i>	3	0	0



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No.	THEME	Number of hours		
		Lectures	Practical hours	Self-training
	<i>Daturae innoxiae semina, Hyoscyami folia, Stramonii folia.</i>			
	Total: 1st semester 120 hours	15	45	60
11.	Vegetal products containing quinolizidine alkaloids: <i>Nupharis lutei rhizomata, Sophorae pachycarpae herba, Thermopsis lanceolatae herba</i> ; isoquinoline: <i>Berberidis cortex, B. folia, B. fructus, B. radices, Chelidonii herba, Glauci flavi herba, Macleayae herba, Papaveris capita</i> ; indole: <i>Catharanthi herba, Passiflorae incarnatae herba, Rauwolfiae radices, Secale cornutum, Strychni semina.</i>	2	8	9
12.	Vegetal products containing purine alkaloids: <i>Cacao semina, Coffeae semina, Colae semina, Theae folia</i> ; terpenoids: <i>Aconiti tuber, Delphinii consolidae flores</i> ; steroidal: <i>Solani laciniati herba, Veratri rhizomata cum radicibus</i> ; acyclic alkaloids: <i>Capsici fructus, Colchici semina, Ephedrae herba</i> . Chemical analysis of vegetal products with alkaloids.	2	8	6
13.	Phenolic compounds. Classification. Biosynthesis. Simple phenols and their glycosides. Vegetal products containing phenolic-glycosides: <i>Vitis-idaeae cormus, Vitis-idaeae folia, Uvae-ursi folia</i> . Phloroglucins. Vegetal products containing phloroglucides: <i>Filicis maris rhizomata, Rhodiolae roseae rhizomata cum radicibus</i> . Lignans. Vegetal products containing lignans: <i>Podophylli peltati rhizomata cum radicibus, Schizandrae fructus, Schizandrae semina</i> . Coumarins and chromones. Generality. Vegetal products containing coumarins and chromones: <i>Ammi majoris fructus, Ammi visnagae fructus, Anethi graveolens fructus, Angelicae rhizomata cum radicibus, Meliloti herba, Pastinacae fructus.</i>	2	8	9
14.	Anthracene derivatives and their heterosides. Generality. Vegetal products containing anthracene derivatives: <i>Aloe arborescens cormus, Aloe arborescens folia, Frangulae cortex, Hyperici herba, Rhamni catharticae fructus, Rhei radices, Rubiae rhizomata et radices, Rumicis radices, Sennae folia, Sennae fructus.</i>	2	4	6
15.	Flavonoids. Generality. Vegetal products containing flavonoids: <i>Centaureae cyani flores, Crataegi flores, Crataegi fructus, Fagopyri sagittati herba, Sophorae japonicae alabastra, Sophorae japonicae fructus, Leonuri herba, Polygoni avicularis herba, Polygoni hydropiperis herba, Polygoni persicariae herba.</i>	2	8	9
16.	Vegetal products containing flavonoids: <i>Aroniae fructus, Scutellariae baicalensis radices, Helichrysi arenarii flores, Ononidis radices</i> . Medicinal species. Pharmacognostical analysis of medicinal species. Nomenclature of the officinal species.	2	4	6
17.	Tannins. Classification. Vegetal products containing tannins: <i>Alni fructus, Bergeniae rhizomata, Bistortae rhizomata, Cotini coggygriae folia, Gei rhizomata cum radicibus, Hamamelidis cortex, Hamamelidis folia, Pruni padi fructus, Rhus coriariae folia, Quercus</i>	2	8	6



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No.	THEME	Number of hours		
		Lectures	Practical hours	Self-training
	<i>cortex, Sanguisorbae rhizomata et radices, Tormentillae rhizomata, Vaccinii myrtilli cormus, Vaccinii myrtilli fructus.</i>			
18.	Vegetal products with different active principles: <i>Asperulae odoratae herba, Caricae folia, Caricae fructus, Cucurbitae semina, Fragariae folia, Kalanchoe cormus, Paeoniae herba, P. rhizomata et radices, Phaseoli fructus sine seminibus, Rubi idaei fructus, Silybi fructus, Ulmariae herba, Visci stipites.</i>	1	4	6
20.	From the history of use and study of flora and medicinal plants in the Republic of Moldova. vegetal and phytotherapeutic products according to the State Nomenclature of Medicines. Rational use of plants and phytotherapeutic products.	-	4	9
21.	Pharmacognostical analysis of vegetable products.	-	4	9
Total IInd semester 159 hours		15	60	75
Total: 270 hours		30	105	135

VI. PRACTICAL ABILITIES PURCHASED AT THE END OF THE COURSE

Purchased practical tools:

- to develop skills of identification of medicinal plants and vegetal products according to the macro- and microscopic characters;
- to apply correctly the rules of collection, drying and primary processing of vegetal products according to the nature of vegetal products and the group of chemical compounds;
- to apply qualitative and quantitative analysis of vegetal and phytotherapeutic products in pharmaceutical enterprises;
- to communicate with the doctor and the patient regarding to the pharmaceutical forms and phytopreparations, precautions in their administration;
- to know the rules of storage in pharmaceutical enterprises of vegetal and phytotherapeutic products according to the groups of chemical compounds;
- to apply the knowledge and contribute in the rational use of vegetal and phytotherapeutic products.

VII. REFERENCE OBJECTIVES OF CONTENT UNITS

Objectives	Content units
Chapter 1. Pharmacognosy. The analysis of vegetal products	
<ul style="list-style-type: none"> • to define the content of pharmacognosy and its tasks; • to acquire methods of pharmacognostical analysis of 	<p>The concept of interdependence of pharmacognosy with other disciplines.</p> <p>The principles of classification of medicinal plants and vegetal products.</p>



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Objectives

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- vegetal products;
- to know how to work with the Analytical Normative Documentation and pharmacopoeias reference;
- to be able to apply techniques of pharmacognostical analysis for different types of vegetal products and active principles.

Methods of pharmacognostical analysis of vegetal products from different morphological groups: macroscopic, microscopic and phytochemical. Standardization of vegetal products.
Analytical Normative Documentation.

Chapter 2. Polyholosides. Vegetal products containing polyholosides

- to know the classification of polyholosides according to their chemical structure;
- to be able to highlight macroscopically and microscopically the vegetal products containing polyholosides;
- to know the action of vegetal products containing polyholosides according on their chemical composition.

Polyholosides. Classification of polyholosides according to their chemical structure. Vegetal products containing polyholosides: *Althaeae herba*, *Althaeae radices*, *Farfarae folia*, *Laminariae stipites*, *Malvae flores*, *Malvae folia*, *Plantaginis majoris folia*, *Tiliae flores cum bracteis*, *Verbasci flores*.
Macro-, microscopic analysis of vegetal products with polyholosides. Vegetal products and phytodrugs containing polyholosides.

Chapter 3. Vitamins. Vegetal products containing vitamins

- to define vitamins according to chemical structure, physiological role and degree of solubility;
- to describe macroscopically and microscopically the vegetal products with vitamins;
- to know vegetal products containing vitamins, phytodrugs and their uses.

Vegetal products containing vitamins: *Bidenstis herba*, *Bursae pastoris herba*, *Calendulae flores*, *Hippophaes rhamnoides fructus*, *Maydis stigmata*, *Ribes nigri fructus*, *Rosae fructus*, *Sorbi fructus*, *Urticae folia*, *Viburni cortex*, *Viburni fructus*.
Macro- and microscopic analysis of vegetal products containing vitamins. Chemical analysis of vitamins in vegetal products. Identification and dosage of ascorbic acid in fruit of rose (*Rosae fructus*).

Chapter 4. Terpenoids. Vegetal products containing essential oils

- to know the biosynthesis of terpenoids;
- to define essential oils after their chemical classification;
- to know methods of obtaining of essential oils;
- to identify organoleptic essential oils and by numerical indices;
- to quantify essential oils in vegetal products;
- to describe macroscopically and microscopically vegetal products containing essential oils;
- to know the action and particularities

Vegetal products containing:
- acyclic monoterpenoids: *Coriandri fructus*, *Lavandulae flores*, *Melissae herba*, *Rosae flores*;
- monoterpenoids: *Carvi fructus*, *Eucalypti folia*, *Menthae piperitae folia seu herba*, *Salviae folia*;
- bicyclic monoterpenoids: *Hyssopi herba*, *Juniperi fructus*, *Tanacetii flores seu herba*, *Valerianae rhizomata cum radicibus*. Camphorus sources: *Pini silvestris cormus*;
- sesquiterpenoids: *Arnicae flores*, *Betulae gemmae*, *Betulae folia*, *Calami rhizomata*, *Chamomillae flores*, *Inulae rhizomata et radices*, *Populi nigrae gemmae*;
- aromatic terpenoids: *Anisi vulgaris fructus*, *Asari folia*, *Asari rhizomata*, *Basilici herba*, *Foeniculi fructus*, *Origani vulgaris herba*, *Serpilli herba*, *Thymi vulgaris herba*.



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<p>in the administration of products containing essential oils;</p> <ul style="list-style-type: none">to define the use of essential oils in the pharmaceutical and cosmetic industry.	<p>Structure formulas by groups of active principles. Macroscopic, microscopic and chemical analysis of vegetal products containing essential oils. Medicinal products containing essential oils and their pharmaco-therapeutic action.</p>
Chapter 5. Vegetal products containing resins and bitter substances	
<ul style="list-style-type: none">to know the resins, bitter and their role;to define macroscopically and microscopically vegetal products containing resins and bitter substances;to know vegetal products, phytodrugs with resins and bitter substances, as well as particularities and restrictions in their administration.	<p>Vegetal products containing resin and bitter substances. Macroscopic and microscopic analysis of vegetal products containing bitter substances: <i>Absinthii folia</i>, <i>Absinthii herba</i>, <i>Cardui benedicti herba</i>, <i>Centaurii herba</i>, <i>Gentianae radices</i>, <i>Marrubii herba</i>, <i>Millefolii flores</i>, <i>Millefolii herba</i>, <i>Taraxaci folia</i>, <i>Taraxaci herba</i>, <i>Taraxaci radice</i>; and resins: <i>Convolvuli herba</i>, <i>Lupuli strobili</i>.</p> <p>Particularities in the administration of vegetal products and phytodrugs containing bitter substances.</p>
Chapter 6. Vegetal products containing heterosides	
<ul style="list-style-type: none">to define heterosides, including cardiotonic, according to their chemical structure;to know the particularities of the dynamics of the accumulation, the conditions of harvesting, conditioning and storing of the vegetal products containing heterosides;to describe macroscopically and microscopically the vegetal products containing heterosides and their preparations;to know methods of chemical and biological analysis specific to cardiotonic heterosides.	<p>Classification of heterosides according to their chemical structure. Vegetal products containing heterosides: <i>Amygdalari semina</i>, <i>Sambuci flores</i>, <i>Sinapis semina</i>.</p> <p>Vegetal products containing cardiotonic heterosides: <i>Adonidis vernalis herba</i>, <i>Convallariae flores</i>, <i>Convallariae folia</i>, <i>Convallariae herba</i>, <i>Digitalis lanatae folia</i>, <i>Digitalis purpureae folia</i>, <i>Erysimi diffusi herba</i>, <i>Strophanthi semina</i>.</p> <p>Macroscopic and microscopic analysis of vegetal products containing cardiotonic heterosides. Chemical analysis and biological standardization of cardiotonic heterosides. Particularities in the administration of medicinal products containing cardiotonic heterosides.</p>
Chapter 7. Vegetal products containing saponosides	
<ul style="list-style-type: none">to know the conditions of harvesting, conditioning and storing of vegetal products containing saponosides;to describe macroscopically and microscopically vegetal products containing saponosides;to know methods of physical, chemical and biological analysis specific of saponosides;to know the action of products with	<p>Triterpenic and steroidal saponosides, spreading, harvesting, conditioning. Vegetal products containing: saponosides: <i>Araliae mandshuricae radices</i>, <i>Dioscoreae rhizomata cum radicibus</i>, <i>Equiseti arvensis herba</i>, <i>Glycyrrhizae glabra radices</i>, <i>Hippocastani cortex</i>, <i>Hippocastani flores</i>, <i>Hippocastani folia</i>, <i>Hippocastani semina</i>, <i>Ginseng radices</i>, <i>Orthosiphonis folia</i>, <i>Polemonii rhizomata cum radicibus</i>, <i>Primulae veris folia</i>, <i>Primulae veris rhizomata cum radicibus</i>, <i>Saponariae radices</i>.</p> <p>Macroscopic, microscopic analysis of vegetal products</p>



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<p>saponosides;</p> <ul style="list-style-type: none">to define warnings and contraindications in the administration of products containing saponoside	<p>containing saponosides. Chemical analysis and biological standardization of saponosides. Particularities in the administration of medicinal products containing saponosides.</p>
Chapter 8. Vegetal products containing alkaloids	
<ul style="list-style-type: none">to know the biosynthesis of tropane alkaloids;to define the alkaloids according to their chemical structure;to know the particularities of the collection and conditioning of vegetal products with alkaloids;to describe macroscopically and microscopically the vegetal products containing alkaloids;to devise qualitative and quantitative analysis methods for the identification and dosing of alkaloids in vegetal products;to define the pharmaco-therapeutic actions and the degree of toxicity of products with alkaloids according to their structural variety;to know vegetal products and medicines products containing, alkaloids, contraindications and warnings in their administration.	<p>Alkaloids. Classification. The biosynthesis of tropane alkaloids, the way of collecting, conditioning and storing of vegetal products containing alkaloids. Vegetal products containing alkaloids:</p> <ul style="list-style-type: none">- pyrrolidines: <i>Senecionis platyphylloides herba, Symphyti radices</i>;- derivatives of coniine: <i>Conii fructus</i>;- derivatives of nicotine: <i>Nicotianae folia</i>;- tropane alkaloids: <i>Belladonnae folia, B. herba, B. radices, Daturae innoxiae herba, Daturae innoxiae semina, Hyoscyami folia, Stramonii folia</i>;- quinolizidine alkaloids: <i>Nupharis lutei rhizomata, Sophorae pachycarpae herba, Thermopsis lanceolatae herba</i>;- isoquinoline: <i>Berberidis cortex, B. folia, B. fructus, B. radices, Chelidonii herba, Glauci flavi herba, Macleayae herba, Papaveris capita</i>;- indole: <i>Catharanthi herba, Passiflorae incarnatae herba, Rauwolfiae radices, Secale cornutum, Strychni semina</i>;- purine: <i>Cacao semina, Coffeae semina, Colae semina, Theae folia</i>;- terpenoids: <i>Aconiti tuber, Delphinii consolidae flores</i>;- steroidal: <i>Solani laciniati herba, Veratri rhizomata cum radicibus</i>;- acyclic alkaloids: <i>Capsici fructus, Colchici semina, Ephedrae herba</i>. <p>Macroscopic, microscopic and chemical analysis of vegetal products containing alkaloids. Particularities in the administration of medicinal products. containing alkaloids.</p>
Chapter 9. Vegetal products containing phenolic compounds, coumarins and chromones	
<ul style="list-style-type: none">to know the classification and biosynthesis of phenolic compounds and coumarins;to describe macroscopically and microscopically the vegetal products containing simple phenols, floroglucides, lignans, coumarins, chromones and their phytopreparations.	<p>Phenolic compounds. Classification and biosynthesis. Vegetal products containing: simple phenols and their heterosides: <i>Vitis-idaeae cormus, Vitis-idaeae folia, Uvae-ursi folia</i>; phloroglucides: <i>Filicis maris rhizomata, Rhodiola roseae rhizomata cum radicibus</i>; lignans: <i>Podophylli peltati rhizomata cum radicibus, Schizandrae fructus, Schizandrae semina</i>.</p> <p>Vegetal products containing coumarins and chromones: <i>Ammi majoris fructus, Ammi visnagae fructus, Anethi</i></p>



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	<i>graveolens fructus, Angelicae rhizomata cum radicibus, Meliloti herba, Pastinacae fructus.</i> Macroscopic, microscopic and phytochemical analysis of vegetal products containing phenolic compounds, coumarins and chromones, Action, uses and phytopreparations.
Chapter10. Vegetal products containing anthracene derivatives	
<ul style="list-style-type: none">to define anthracene derivatives after their chemical classification;to describe macroscopically and microscopically the vegetal products containing anthracene derivatives;to know methods of analysis in the identification and dosing of anthracene derivatives in vegetal products;to describe the particularities of administration of products with anthracene derivatives.	Classification of anthracene derivatives and their heterosides. Vegetal products containing anthracene derivatives: <i>Aloe arborescens cormus, Aloe arborescens folia, Frangulae cortex, Hyperici herba, Rhamni catharticae fructus, Rhei radices, Rubiae rhizomata et radices, Rumicis radices, Sennae folia, Sennae fructus.</i> Macroscopic, microscopic and chemical analysis of vegetal products with anthracene derivatives. Particularities and contraindications in the administration of medicinal products containing anthracene derivatives.
Chapter 11. Vegetal products containing flavonoids	
<ul style="list-style-type: none">to know the classification of flavonoids;to describe macroscopically and microscopically of vegetal products containing flavonoids;to apply methods of analysis in the identification and dosing of flavonoids;to know vegetal products and phytodrugs containing flavonoids.	Flavonoids. Classification. Generality. Vegetal products containing flavonoids: <i>Aroniae fructus, Centaureae cyani flores, Crataegi flores, Crataegi fructus, Fagopyri sagittati herba, Helichrysi arenarii flores, Leonuri herba, Ononidis radices, Polygoni avicularis herba, Polygoni hydropiperis herba, Polygoni persicariae herba, Sophorae japonicae alabastra, Sophorae japonicae fructus, Scutellariae baicalensis radices.</i> Macroscopic and microscopic analysis of vegetal products containing flavonoids. Methods of identification and dosing of flavonoids in vegetal products. Action and uses.
Chapter 12. Medicinal species	
<ul style="list-style-type: none">to define the medicinal species;to know medicinal species according to the State Nomenclature of Medicines;to acquire the pharmacognostical analysis of the medicinal species.	Medicinal species. Generality. Pharmacognostical analysis of medicinal species by macroscopic, microscopic and phytochemical identification of vegetal products and their standardization according to pharmacopoeial methods. Nomenclature of medicinal species and knowledge of the active principles of their composition.
Chapter13. Vegetal products containing tannins	
<ul style="list-style-type: none">to know the classification of tannins;to describe macroscopically and microscopically vegetal products containing tannins;to know methods of analysis in the identification and dosing of tannins;	Vegetal products containing tannins: <i>Alni fructus, Bergeniae rhizomata, Bistortae rhizomata, Cotini coggygiae folia, Gei rhizomata cum radicibus, Hamamelidis cortex, Hamamelidis folia, Pruni padi fructus, Rhus coriariae folia, Quercus cortex, Sanguisorbae rhizomata et radices, Tormentillae rhizomata, Vaccinii myrtilli cormus, Vaccinii myrtilli fructus.</i>



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Objectives	Content units
<ul style="list-style-type: none">to know the pharmaco-therapeutic action of tannins products and their phytodrugs.	Macroscopic and microscopic analysis of vegetal products with tannins. Methods of identification and dosing of tannins in vegetal products. Particularities in the administration of medicinal products containing tannins.
Chapter 14. Vegetal products with various active principle	
<ul style="list-style-type: none">to define vegetal products containing various active principles;to know their active principles and pharmacotherapeutic profile.	Pharmacognostic study of vegetal products with various active principle: <i>Asperulae odoratae herba</i> , <i>Caricae folia</i> , <i>Caricae fructus</i> , <i>Cucurbitae semina</i> , <i>Fragariae folia</i> , <i>Kalanchoe cormus</i> , <i>Paeoniae herba</i> , <i>Paeoniae rhizomata et radices</i> , <i>Phaseoli fructus sine seminibus</i> , <i>Rubi-idaei fructus</i> , <i>Silybi fructus</i> , <i>Ulmariae herba</i> , <i>Visci stipites</i> . Action, uses and phytopreparations.
Chapter 15. Study of medicinal plants in the Republic of Moldova	
<ul style="list-style-type: none">to know medicinal plants that have served as a scientific study in the Republic of Moldova and "Nicolae Testemitanu" SUMPh;to know the vegetal and phytotherapeutic products after SNM and their rational use.	History of the study and use of medicinal plants in the Republic of Moldova. Protection of the environment and rational use of natural resources. Vegetal and phytotherapeutic products according to the State Nomenclature of Medicines of the Republic of Moldova. Rational use of plant, vegetal products and phytopreparations.

VIII. PROFESSIONAL (SPECIFIC (SC) AND TRANSVERSAL (TC) COMPETENCES AND STUDY OUTCOMES

✓ **Professional (specific) (SC) competences**

- PC1. Knowledge, understanding and use of pharmacognostical specific terms, general principles in the pharmacognostical evaluation of vegetable products.
- PC2. Application of methods of pharmacognostical analysis: macroscopic and microscopic of vegetable products from different morphological groups. Developing skills in acquiring methods of analysis for the identification and dosing of active principles in vegetable products. Knowledge of phytodrugs in terms of action, indications, contraindications, adverse effects, mode of administration and their interactions.
- PC3. Use and adaptation of theoretical knowledge of pharmacognosy to the situations of practical activity, application of the pharmacopoeial requirements in the practical activity by carrying out the pharmacognostical analysis of the vegetable products.
- PC4. Knowledge of vegetable products and active principles responsible for their pharmacotherapeutic action, by actively engaging in laboratory practice and demonstrating the ability to make decisions aimed at continuous improvement.
- PC5. Knowledge of particularities in the administration of medicinal products depending on the nature of the active principles, their rational use. Knowledge of the methodology of scientific research in laboratory practice through the pharmacognostical analyzes.
- PC6. Using the capacity to solve situation problems through good collaboration, promoting the principles of tolerance and compassion towards the consumer of phytodrugs, using of information technologies and multilingual communication.



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✓ **Transversal competences (TC)**

- TC1. Responsible execution of professional tasks with the application of values of professional ethics, tendency to perfect knowledge and practical skills, selection of critical analysis and formulation of conclusions, observance of ethical and deontological rules.
- TC2. Ability to social interaction and group work, prioritization of vocational training.
- TC3. Fitting in interdisciplinary projects, extracurricular activities, performing activities and exercising the specific roles to the team activities. Promoting the spirit of initiative, dialogue, cooperation, positive attitude and respect for colleagues.

✓ **Study outcomes**

- to be able to apply the methods of collecting, conditioning of vegetal products depending on the nature of the vegetal product and the particularities of the accumulation of active principles;
- to know vegetal products, active principles and their pharmacotherapeutic profile;
- to be able to identify vegetal products by macroscopic, microscopic characters and literature;
- to be able to identify the dose the active principles from different vegetal products using the analysis methods according to the pharmacopoeias reference;
- to be competent in the rational use of plants and phytodrugs by knowing their active principles and actions;
- to be able to inform the population, doctors, pharmacists about authorized vegetal products and phytopreparations in the Republic of Moldova;
- to be able to implement the knowledge gained in the research activity.

Note. Study outcomes(are deduced from the professional competencies and formative valences of the informational content of the discipline).

IX. STUDENT'S SELF-TRAINING

No.	Expected product	Implementation strategies	Assessment criteria	Implementation terms
1.	Working with information sources	Evaluation and acquisition of the provided information at the practical training of pharmacognosy; Selection of compulsory and additional sources according to the respective themes; Analyzing and evaluation of the relevant questions; Define conclusions regarding to subjects importance.	Interpretative skills; The ability to select the essentials; The ability to define the conclusions.	During the semesters
2.	Preparing and supporting of the presentations Power point	Selection of the theme and establishment of the components of thematic project; Establishing the terms of the realization and the requirements; Mentioning of practical applications, creativity elements, conclusions and sources of bibliography.	The degree of penetration in the essence of the project theme; The level of scientific argumentation of necessity; Formation of the personal attitude, coherence of exposure and scientific correctness; Presentation method;	During the semesters



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			Student and teacher reviews.	
3.	Case studies	Informing of students with possible case scenarios for the respective subjects; Description of the case situation; Developing of operative capabilities as appropriate; Ability to solve similar cases.	Assessing the application of knowledge in case studies; The ability to apply the gained knowledge in the rational use of vegetal products.	During the semesters
	Portfolio (plants used in traditional medicine, evaluation of phytochemical research methods, elucidation of mechanisms of action of active principles)	The strategies in the realization of portfolio: 1) electronic format; 2) paper format with informative materials, schemes, images; 3) informative, video, audio. Exploring bibliographic, electronic sources; Mentioning the practical applications of the material presented in the portfolio.	Using the portfolio to assess the level of student competency development; Capacity to apply the portfolio materials to the proper training of the pharmacist specialist; The appreciation will consist in the evaluation of the content, the correctness of the fulfillment, the accuracy, the value of the presented information, the veracity of the bibliographic sources.	During the semesters

X. METHODOLOGICAL SUGGESTIONS FOR TEACHING-LEARNING-ASSESSMENT

• *Teaching and learning methods used*

The teaching of Pharmacognosy discipline uses different methods and classical didactic methods, oriented towards the efficient acquisition and achievement of the objectives of the didactic process. In the course of the Pharmacognosy, along with the traditional methods (lesson-exposure), are used the modern methods with the information technologies. During the laboratory works are used individual forms, group activity, or phytochemical laboratory works. For the deeper learning of the material are used different systems (scientific language, graphical and computerized language) and teaching materials (tables, schemes, herbaria, vegetable products, phytodrugs, etc.). In the lectures and laboratory works are applied information communication technologies: PowerPoint presentations. At the end of the laboratory work is presented the protocol, according to the requirements.

• *Applied teaching strategies / technologie (specific to the discipline)*

In the process of studying pharmacognosy, the students acquire new methods and practical skills: they systematically learn to work, to think scientifically, to analyze, to recapitulate, to find the connection between theory and practice. Particular attention is paid to the student's individual work, content and organization. Individual work leads to the development of creative attitudes and offers the opportunity to gain self-knowledge. Among the applied teaching technologies are: "Group interview"; "Case study".

Recommended learning methods for pharmacognosy

- in the auditorium (macroscopic and microscopic study of vegetable products, phytochemical



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analysis of vegetable product, analysis of medicinal species and phytodrugs);

- outside of the auditorium (preparation for practical work, learning the lecture material, preparation for totalizations, and presentation of individual work (papers, analysis schemes, PowerPoint presentations).

- **Methods of assessment** (including the method of final mark calculation)

I semester

- **Current:** 3 works for evaluating theoretical knowledge (1 - through testing, 1 - oral discussions, 1 - written on topics) and individual work (presentation of the PowerPoint thematic project or the thematic portfolio).

- **Final: exam** - consisting of 3 grades: semester average; SIMU test-editor test and evaluation of practical skills (identification of 10 vegetal products, medicinal plants, pharmacological actions and phytopreparations).

II Semester

- **Current:** 2 works for evaluating theoretical knowledge (1 - by testing, 1 - oral discussions); 1 - individual work (presentation of the PowerPoint thematic project or the thematic portfolio).

- **Final: exam** - consisting of 3 grades: semester average; SIMU test-editor test and evaluation of practical skills (identification of 10 vegetal products, medicinal plants, pharmacological actions and phytopreparations).

Are not admitted to the exam- the students who have not recovered their absences from laboratory work and those with an annual average below grade 5.

Method of mark rounding at different assessment stages

Intermediate marks scale (annual average, marks from the examination stages)	National Assessment System	ECTSEquivalent
1,00-3,00	2	F
3,01-4,99	4	FX
5,00	5	E
5,01-5,50	5,5	
5,51-6,0	6	D
6,01-6,50	6,5	
6,51-7,00	7	C
7,01-7,50	7,5	
7,51-8,00	8	B
8,01-8,50	8,5	
8,51-8,00	9	A
9,01-9,50	9,5	
9,51-10,0	10	

The average annual mark and the marks of all stages of final examination (computer assisted, test, oral) - are expressed in numbers according to the mark scale (according to the table), and the final mark obtained is expressed in number with two decimals, which is transferred to student's record-book.



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Absence on examination without good reason is recorded as "absent" and is equivalent to 0 (zero). The student has the right to have two re-examinations.

XI. RECOMMENDED LITERATURE:

A. Compulsory:

1. Nisteanu A. Farmacognozie. Chişinău, 2000.
2. Nisteanu A., Calalb T. Analiza farmacognoxică a produselor vegetale medicinale. Compendiu. Chişinău, 2016.
3. Cojocaru-Toma M. Produse vegetale și fitopreparate din Republica Moldova. Compendiu pentru lucrări de laborator la farmacognozie. Chişinău, 2017.
4. Cojocaru-Toma M., Chiru T. Analiza farmacognoxică a speciilor medicinale. Chişinău, 2019.
5. Chiru T., Nisteanu A. Determinator de produse vegetale medicinale. Chişinău, 2018.

B. Additional

1. European Pharmacopoeia, vol. I, II, 2016.
2. Farmacopeea română, ediția X. Editura medicală, București, 1993.
3. Государственная Фармакопея XIII издание. Москва, 2015.
4. Государственная Фармакопея Республики Беларусь. Том II, 2007, Том III, 2009.
5. Matcovschi C., Safta V. Ghid farmacoterapeutic. Editura „Vector”. Chişinău, 2010.
6. Gonciar V., Oobrijanu D., Nisteanu A. Elemente de fitofarmacologie, Chişinău, 2012.
7. Ungureanu I., Ciobanu N., Cojocaru-Toma M., Ciobanu C., Benea A., Pompuş I. Centrul Ştiinţific de Cultivare a Plantelor Medicinale USMF „Nicolae Testemiţanu”, Chişinău, 2019.
8. Cartea Roşie a Republicii Moldova. Ştiinţa, 2015.
9. Avram Ş., Danciu C., Pavel I. Farmacognozie, Partea II, Timişoara, 2017.
10. Miron A., Stănescu U., Hănceanu M., Aprotosoaii C. Bazele farmaceutice, farmacologice și clinice ale fitoterapiei, vol. I-II, Iași, 2002.
11. Муравьева Д. Фармакогнозия. Москва, 2010.
12. Istudor V. Farmacognozie. Fitochimie. Fitoterapie. Vol. I, II, III. Editura Medicală, București, 1998, 2001, 2005.
13. Danciu C., Avram Ş., Pavel I. Farmacognozie, Partea I, Timişoara, 2015.